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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 26.

B. T. GALLOWAY, Chief of Bureau.

SPANISH ALMONDS

AND

THEIR INTRODUCTION INTO AMERICA.

BY

DAVID G. FAIRCHILD, Agricultural Explorer,
SEED INTRODUCTION AND DISTRIBUTION.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

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JORDAN ALMONDS (NATURAL SIZE).

1, Ventral view; 2, lateral view; 3, dorsal view; 4, base; 5, apex; 6, cross section; 7, kernel in position; 8, base and apex of kernel; 9, 10, kernel, split; 11, kernel, edge view; 12, kernel, lateral view. [Photograph by Collins.]

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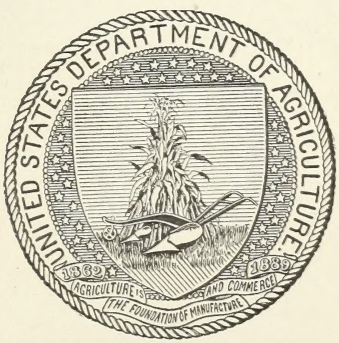

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1902.

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., July 7, 1902.

Sir: I have the honor to transmit herewith a paper on Spanish Almonds and Their Introduction into America, and respectfully recommend that it be published as Bulletin No. 26 of the Bureau series. The paper was prepared by Mr. David G. Fairchild, Agricultural Explorer, and was submitted by the Assistant in Charge of Seed and Plant Introduction.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

PREFACE.

The accompanying paper is one of a series, which it is hoped can be issued from time to time, embodying observations made on specific crops by the agricultural explorers of this Department. Already several such papers have appeared and have aroused general interest in the subjects discussed.

Almond culture is an important industry in California, and, to a more limited extent, in Arizona and Utah. It is hoped, therefore, that this bulletin may prove of value to these regions. The introduction of the varieties of almonds herein discussed can not, apparently, be without great benefit.

ERNST A. BESSEY,
Assistant in Charge of Seed and Plant Introduction.

OFFICE OF SEED AND PLANT INTRODUCTION,
February 14, 1902.

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SPANISH ALMONDS AND THEIR INTRODUCTION INTO AMERICA.

INTRODUCTION.

The most valuable almonds of commerce are those grown in southeastern Spain. They are hard-shelled varieties and bring on the English and American markets 8 to 10 cents a pound more than any other sort, being in favor with confectioners for the manufacture of their best salted and sugar-coated almonds. These superlative sorts are imported from Spain by Boston and New York importers for retail to confectioners, many thousands of dollars being expended annually on this import.

Since 1885 Californians have been growing almonds quite successfully, and there are in certain valleys in the State localities where almond culture has become distinctly profitable.

According to the statistics collected by Mr. W. A. Taylor and published in the Yearbook of the Department of Agriculture for 1897 as much as 2,500,000 pounds had been produced in California in a single year prior to that date. Commercial estimates of the crop of 1900, furnished through the kindness of Mr. Taylor, place the almond yield of California at nearly 5,500,000 pounds in that year. The quality of the product is excellent for many uses, but confectioners prefer the imported article, as is evidenced by the fact that they imported in 1897 over $683,000 worth, largely from Spain. It has been assumed that the superiority of these Spanish nuts over the Californian lies in some unexplained and unexplainable peculiarity in the climate of southeastern Spain which finds no equivalent in California. The better informed growers, however, have known that the question was largely a matter of variety, and that the best Spanish sort had never been introduced into America. The matter of its introduction may have been discussed prior to 1893 by California horticulturists, but up to that year, so far as the writer has been able to discover, only the kernels, which form the commercial article, had been known in this country. In 1893 the Division of Pomology of the Department of Agriculture secured from Mr. Charles Heath, United States consul at Catania, Sicily, a handful of the uncracked nuts which he had secured from a firm in Malaga. These were of the so-called Jordan variety, and were said to have been grown on some islands off the Spanish coast. The remark-

ably distinct form of these nuts at once attracted the attention of Mr. H. E. Van Deman, then Chief of the Division of Pomology, and Mr. W. P. Corsa, the nut specialist of the Division, and in his monograph on nut culture in the United States,[a] which was published three years later, Mr. Corsa gave a description, with a drawing of the nut, and strongly recommended its introduction into California. Owing to many difficulties this suggestion seems never to have been followed, although almond growing in California has continued to increase in importance, and certain French sorts, including a kind known as the Provence and supposed to be the same as the Jordan, have been introduced and are now on trial in that State. Heretofore no one has succeeded in getting the scions of trees of the best Spanish almonds, although their kernels continue to be imported into the country from Malaga and Alicante, on the southeast coast of the peninsula.

As agricultural explorer of the Section of Seed and Plant Introduction, the writer last August made a somewhat hurried trip through the almond orchards of Spain, at the time when the almonds were being gathered, to secure scions. It is a pleasure to say that the scions collected are already growing at several places in the United States.[b]

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[a] Nut Culture in the United States, Embracing Native and Introduced Trees. U. S. Department of Agriculture, Division of Pomology. 1896.

[b] The following statement regarding an earlier introduction of Spanish almonds than that made by the Department was received from Mr. W. A. Taylor after Mr. Fairchild's manuscript had been sent to the printer:

Since the Jordan almond buds secured by Mr. Fairchild reached this country and were successfully propagated, Mr. John Rock, manager of the California Nursery Company, Niles, Cal., has sent us samples, evidently of the true Jordan variety, grown on trees imported by him in dormant bud in February, 1897. Mr. Rock's statement regarding his introduction is substantially as follows:

In 1896 he requested a French firm to secure buds of the Jordan almond in Malaga, Spain, and to propagate them for him at their nursery in France. This was done, and a lot of dormant budded trees on Myrobolan plum stocks reached him on February 17, 1897.

Fearing that the almond would not thrive on the Myrobolan roots, he grafted 100 of these dormant buds on old peach trees, using the entire stock of the Myrobolan plum, with the dormant almond bud upon it, as a scion, the balance being planted out in the usual way. Nearly all grew, but instead of being of one variety they were found to consist of many kinds, most of them resembling the common, hard-shelled almond. They made but a stunted growth and produced nuts in the third and fourth years. Three of the trees bore fruit that was apparently of the Jordan type, the nuts being of an oblong, curved sort.

Mr. Rock, early in 1902, sent samples of these nuts to Consul Ridgely at Malaga, who submitted them to dealers there for identification. They pronounced them the true Jordan almond.

It would appear from this that the credit for the introduction of the Jordan almond belongs to Mr. Rock, although the Department was not informed of this until after the stock secured by Mr. Fairchild had been established at several points in the United States.

THE ALMOND INDUSTRY IN SPAIN.

Almond growing in Spain is a local industry, its main centers being Malaga and Alicante, although other regions along the coast and even the Balearic Islands, it is said, produce small quantities of the nut. The culture is carried on with various degrees of carefulness. Large plantations on the plains about Alicante, carefully tilled and well taken care of, remind one of American orchards, with their straight rows of well pruned trees and cultivated soil (Pl. I, figs. 2 and 3). In many fields the almond, olive, fig, and carob trees are mixed, with no attempt at regularity, while in the region about Malaga the foothills are covered with almond trees, between the rows of which grapevines are planted. Whether owing to this mixed culture or for tradition's sake, the trees are planted far apart, 20-foot intervals being frequent. This does not appear excessive; as the trees reach a large size and live to a ripe old age, fifty years not being uncommon.

While the kind of soil no doubt plays a certain part in the production of a fine almond, the writer does not believe it decides in any way the form of the variety.

The best land for almonds in Spain is that of the foothills or sierras. This is a gravelly loam, which during August becomes as dry as dust and breaks up into irregular but not very hard lumps (Pl. I, fig. 3). It is of a light yellowish-gray, sometimes reddish color, and is underlaid by a bed of gravel and rock so firm that it is difficult to get a soil auger into it. Such soil, according to Prof. Milton Whitney, Chief of the Bureau of Soils, to whom samples have been submitted, resembles that of the foothills of California.[a]

The climate of this almond region is a very mild one. Freezes occur in winter and ice a half inch in thickness often forms on the water butts, but a minimum of less than 20° must be uncommon, even in the northernmost limit of almond culture, about Alicante. How severe weather the trees will endure while in dormant bud remains, therefore, to be tested in this country. As regards rainfall in this semiarid region, it is difficult to ascertain the facts, as no reliable published data can be found. From the statements of growers and old inhabitants,

[a] The following is the report of a mechanical analysis of the soil from an almond orchard near Malaga, Spain, made by the Bureau of Soils:

	Per cent.
Organic matter	11.42
Gravel, 2 to 1 mm	6.96
Gravel, 1 to 0.5 mm	6.56
Medium sand, 0.5 to 0.25 mm	3.12
Fine sand, 0.25 to 0.1 mm	10.74
Very fine sand, 0.1 to 0.05 mm	7.64
Silt, 0.05 to 0.005 mm	33.54
Clay, 0.005 to 0.0001 mm	20.22

The water-soluble material is "0.13 per cent in form of bicarbonates."

however, the writer concludes that the months of July, August, and September are practically rainless and that the winter rains are neither frequent nor very abundant. The region is essentially a dry one, verging on the arid, and in sheltered portions of it, at Elche, even the tender date palm is grown. It is the only place in all Europe where this palm is grown extensively or where it bears really edible, though not excellent, fruit.

This region is a land of perpetual sunshine, and in it the olive, fig, pomegranate, the famous Malaga grape, and the carob form characteristic cultures, although the center of each of these cultures is not in the immediate locality. The olives, for example, which furnish the Spanish olives of commerce, are grown farther inland, about Granada and Seville; the figs are more important on the Balearic Islands and in southern Portugal; the pomegranates are raised on the salt lands, where figs refuse to do well; the orchards of carobs are largest about Valencia, some distance from the almond region; and the Malaga table grapes have their center about Almeria; the raisin grapes are in the neighborhood of Malaga, it is true, but occur largely in the valleys, while the almonds are generally grown in the foothills. (Pls. II and III.)

VARIETIES OF SPANISH ALMONDS.

It is probable that there are a score or more varieties of Spanish almonds which have been propagated by budding, but owing to the antiquated methods in vogue in the almond regions, little reliable information about most of these sorts is obtainable.

The writer was astonished to learn how local these sorts are and how little could be learned from one grower about sorts grown in even a neighboring locality. This would not be so surprising if one remembered the dearth of horticultural literature at the disposal of the almond growers. Probably many identical sorts are known by different names in different localities.

The English buyers, who were formerly about the only ones, have given names to some of the sorts that are quite different from those known among the growers themselves. The best variety is known in commerce as the Jordan, and yet not once was this name heard applied to the variety by the growers. They call it the "Large e fine," a descriptive name meaning simply "the large, fine almond." As to the origin of this name Jordan there is nothing new to offer. It may be a corruption of the French word "jardin," meaning garden, or the name can easily have related to the origin of the first importations into England, erroneously supposed to have come from the River Jordan. If the word Jordan occurred in the Spanish trade the former assumption might have some weight, but the term seems to have originated among the English importers.

The trade names, as distinct from the varietal, relate to the grades more than to the different sorts. They are "donkeys," "horses," "tigers," "lions," "elephants," and "mammoths," according to the size of the shelled nuts. The "donkeys" are small and bring a lower price, while the "mammoths" are simply the abnormally large nuts found by the sorters who pick over the nuts by hand. These latter bring fancy prices, only a few boxes being secured during the year out of the thousands of all grades which are shipped.

As the nuts are all cracked on the plantation by the men, women, and children, and brought down on donkey backs to the small buyers in the villages, to be sent to the large storehouses of the exporters, these latter know their almonds chiefly from the character of the kernel. Peculiarities of the American tariff, it is said, make the export of shelled nuts more profitable. Purely mechanical devices for grading these almonds, similar to the gold-coin weighing chutes of banking houses, would do away with much of the unnecessary labor of sorting.

There are two more or less distinct types recognized by the exporters of almonds, but these include several varieties.

The Jordan type of nut (see frontispiece and Pl. IV, fig. 1) is the long, narrow, but plump sort, with exceedingly hard, smooth shell, truncated base, and somewhat bent apex, with edges free from a sharp knife-like character common to many bitter almonds. The edge view is more or less arrow-shaped, and there is a distinct dorsi-ventral character to the nut. Its length alone distinguishes it from others of the Spanish sorts, it being by far the longest and slenderest type. Characters in the foliage may be discovered which will distinguish this from other types. No striking peculiarities were noticed, no opportunity occurring to make very careful comparisons.

The fruit itself is rather thin fleshed and covered with a heavy pubescence. The kernel in good specimens nearly fills the cavity of the nut and is covered with a most delicate papery skin. This skin is much thinner and more delicate than that of any other almond in the trade and is one of the most valuable qualities of this variety. In flavor and texture the flesh surpasses in delicacy any other kind.

Attempts have been made to grow this Jordan variety in the neighborhood of Alicante, but without success. Those of the growers with whom the writer talked knew nothing about the sort, so it seems reasonable to assume that these attempts were not made on any considerable scale.

The Valencia class of nut (Pl. IV, figs. 2, 3, and 4; Pl. V, fig. 1; Pl. VI, fig. 1) is radically different in shape from the Jordan, being a short, decidedly heart-shaped form, with a flat, broad kernel, thicker skin, and somewhat less delicate flesh. The longest of these Valencias are often used by shippers for the adulteration of their Jordans, and the extent to which this adulteration goes on is evidenced by the mixed

lot of shapes one sees even among the sugar-coated almonds of the confectioner. Several distinct varieties of almonds are sold by the exporters as Valencias, and a lot of seedling ungrafted trees doubtless contribute their share to make up the bulk of this high but second grade almond.

The two best of the Valencia type found in cultivation in more or less large quantity were the Planeta (Pl. I, fig. 1; Pl. IV, fig. 3; Pl. V, figs. 1 and 2), which is the popular variety grown about Alicante, and the Pastaneta (Pl. IV, fig. 2), which, although superior in flavor and form to the Planeta, is a shier bearer and has proven less profitable. The Planeta is heart-shaped, is much thicker at the base than the apex and with sides unusually straight, while the Pastaneta has a very plump, striking form, truncated at both apex and base. Figures 2 and 3 in Plate IV show these differences distinctly. The Castillet and Fabrica are other sorts of the same general type found growing in a single garden at Alicante, and they merit mention here only to point out the fact that there are doubtless a large number of distinct varieties scattered through the orchards of Spain.

The Valencia nuts are grown about Alicante, and not, as the name would indicate, about Valencia, which latter is distinctly the citrus province of Spain.

The Mollar is a name given to a variety of the soft-shelled almond grown largely for home consumption. (Pl. VI, fig. 1.) It was found growing about Alicante, but the writer suspects it is a name given to any soft-shelled sort. Seedlings without any local names, even, were shown, and some were of sufficient promise to indicate plainly that much can be expected from the seed of these best sorts if judiciously selected. With a view of furnishing almond breeders in America with material for selection, a quantity of nuts was secured for distribution. The bitter almond, used for stocks, is a little, round, sharp-pointed, plump-formed nut, at once distinguishable from the grafted sorts. (Pl. IV, fig. 5.)

METHOD OF PLANTING AND CULTURE.

Most of the almond trees of Spain are grafted, and the bitter variety is usually employed as a stock. Few nurseries exist in the region, and these pay little attention to the almond. Not a single nursery of almond trees was seen, and the writer was informed that, in most cases at least, the seeds of the bitter almond were planted in a rough seed bed, the young trees transplanted to the places they were to occupy in the orchard, and when two years old, or even more, were budded. Budding is done in the spring. The trees are not commonly budded near the ground, but at a height of 2 to 4 feet above it —a fact plainly evident on all the old trees, which show the point of

union of stock and bud some distance above the base of the trunk. (Pl. V, fig. 2; Pl. VII, figs. 1 and 2.)

The flowering season is the deciding moment for the almond more than for almost any other fruit, for it is the earliest flowering of all our cultivated fruit trees, and consequently most subject to injury by late frosts. Even in the sierras about Malaga a total loss of the crop sometimes occurs in certain valleys as a result of a local late frost. The flowering season for the Jordan begins in January or February, as nearly as can be made out from the conflicting statements given, and is not appreciably later for the other sorts grown near Alicante.

The culture as carried on in Spain is simple enough, and seems to consist, in most localities, of watching for the nuts to ripen and in beating them from the trees when the proper season has arrived, which is in early August. (Pl. III, fig. 3.) The nuts are easily separated from the dry, leathery flesh, and are spread out on the rocks to dry, or carefully piled in the courtyard for safe-keeping. (Pl. VII, fig. 3.) When dried sufficiently they are cracked and the kernels taken from them, packed in bags and boxes, and shipped by pack mule to the nearest buyer.

GUMMOSIS OF THE ALMOND.

In some of the almond orchards about Malaga, which were in rather a poor condition, trees were found which were dying from a kind of gummosis that manifested itself in a dying of the bark of the main trunk, a withering and death of the tips of the twigs (Pl. VI, fig. 2), and the formation of gum drops as large as a turkey egg on the trunk and main branches. The fruit of the trees suffering from gummosis was also affected. The shell was discolored in spots, and the kernel was often spotted or the tip covered with a soft gum, which was more or less slimy to the touch. Many trees were seen about the small town of Casara Bonella which were doomed to a speedy death from this disease. Whether or not this gummosis was the effect or the cause of the trouble the writer is unable to say. It seemed to cause the growers no alarm, and was considered by them as a well-known trouble, its prevalence varying with the season. Specimens of the diseased trunks have been submitted to an expert in the Department, and it is possible the cause of the trouble may be discovered.

POSSIBILITY OF ESTABLISHING THE JORDAN ALMOND IN AMERICA.

The principal difficulty in the successful introduction of the Jordan variety of almond into America will be to find localities suited to almond culture which are not subject to late frosts. The soil conditions, if suited to the growth of other good varieties, will, in all probability, fill the requirements put upon them by this superlative sort. Califor-

nians have shown already that they can grow from a half million to two and a half million pounds of almonds per year, and of a quality which "compares favorably with all but the best;" and if regions free from January and February frosts can be discovered there seems no reason to doubt the successful issue of an experiment.

Why no other nation than Spain has grown these varieties is not difficult to explain when one realizes that the nuts are exported almost exclusively to England and this country, and that even the French markets do not handle them. The natural inertia and indifference of the growers in Sicily account for the failure to thoroughly test the cultivation of the Jordan almond there.

Although California is the largest almond producer in America, there are small areas in Texas, New Mexico, Arizona, Nevada, Utah, Idaho, and Oregon where growers should be found who are willing to experiment with these introductions.

DESCRIPTION OF PLATES.

Frontispiece. Jordan almonds. Natural size. 1. Ventral view. 2. Lateral view. 3. Dorsal view. 4. Base. 5. Apex. 6. Cross section. 7. Nut split to show kernel in position. 8. Base of kernel at left; apex of kernel at right. 9 and 10. Kernel, split. 11. Kernel, edge view. 12. Kernel, lateral view.

PLATE I. Almond orchards about Alicante.—Fig. 1. A single large tree of the variety Planeta.—Fig. 2. One of the largest almond orchards near Alicante, showing a fine state of cultivation and freedom from weeds and other vegetation.—Fig. 3. Cultivating an almond orchard near Alicante in August. Note the character of the soil and the freedom from weeds.

PLATE II. Jordan almond orchards about Malaga.—Fig. 1. The low foothills covered with olive and almond trees.—Fig. 2. An old almond orchard among the hills near Cartana. Notice the clean culture.—Fig. 3. Tree of Jordan almond, near the city of Malaga, from which scions were obtained for introduction into the United States.

PLATE III. Scenes in the Spanish sierras, where the best Jordan almonds are grown.—Fig. 1. The village of Almogia; almond trees in the foreground.—Fig. 2. Scattered almond trees on the mountain side.—Fig. 3. Beating the fruit from an almond tree on the mountain side.

PLATE IV. Nuts of five varieties of Spanish almonds fresh from the trees. These are shown in ventral and lateral views within the fleshy envelope and lateral view with half of the envelope removed. All figures reduced one-third.—Fig. 1. Variety Jordan from Malaga.—Fig. 2. Pastaneta from Alicante.—Fig. 3. Planeta from Alicante.—Fig. 4. Mollar from Alicante.—Fig. 5. Bitter almond from Malaga, used as stock for the Jordan.

PLATE V.—Fig. 1. A branch of Planeta almond from Alicante, showing foliage and ripe fruits.—Fig. 2. Tree of Planeta almond growing near Alicante, showing enlargement of trunk due to grafting. Note the clean culture given to the soil.

PLATE VI. Fig. 1. A branch of Mollar almond from Alicante, showing foliage and ripe fruits.—Fig. 2. A branch of Jordan almond affected with gummosis, from a garden at Casara Bonella, Spain.

PLATE VII. Fig. 1. Tree of Jordan almond from which scions were obtained. The enlargement on the trunk is at the point where the tree was grafted.—Fig. 2. Branch of Jordan almond just cut from the tree, showing foliage and ripe fruits. Large almond trees in the background.—Fig. 3. A group of almond growers, descendants of the Moors, in an old Moorish village near Malaga. In the foreground are heaps of uncracked almonds.

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FIG. 1.—SINGLE LARGE TREE OF PLANETA VARIETY.

FIG. 2.—ONE OF THE LARGEST ALMOND ORCHARDS NEAR ALICANTE.

FIG. 3.—CULTIVATING AN ALMOND ORCHARD IN AUGUST.

ALMOND ORCHARDS ABOUT ALICANTE.

FIG. 1.—LOW FOOTHILLS COVERED WITH OLIVE AND ALMOND TREES.

FIG. 2.—AN OLD ALMOND ORCHARD AMONG THE HILLS NEAR CARTANA.

FIG. 3.—TREE OF JORDAN ALMOND NEAR MALAGA, FROM WHICH SCIONS WERE TAKEN.

JORDAN ALMOND ORCHARDS ABOUT MALAGA.

FIG. 1.—THE VILLAGE OF ALMOGIA. ALMOND TREES IN FOREGROUND.

FIG. 2.—SCATTERED ALMOND TREES ON THE MOUNTAIN SIDE.

FIG. 3.—BEATING THE FRUIT FROM AN ALMOND TREE ON THE MOUNTAIN SIDE.

THE SPANISH SIERRAS, WHERE THE BEST JORDAN ALMONDS ARE GROWN.

1. JORDAN ALMONDS FROM MALAGA. 2. PASTANETA ALMONDS FROM ALICANTE.

3. PLANETA ALMONDS FROM ALICANTE. 4. MOLLAR ALMONDS FROM ALICANTE.
5. BITTER ALMONDS FROM MALAGA.

VARIETIES OF SPANISH ALMONDS FRESH FROM THE TREES (REDUCED ONE-THIRD).

FIG. 1.—BRANCH OF PLANETA ALMOND FROM ALICANTE.

FIG. 2.—TREE OF PLANETA ALMOND NEAR ALICANTE.

Bul. 26, Bureau of Plant Industry, U. S. Dept. of Agriculture.

FIG. 1.—BRANCH OF MOLLAR ALMOND FROM ALICANTE.

FIG. 2.—DISEASED BRANCH OF JORDAN ALMOND FROM CASARA BONELLA.

Bul. 26, Bureau of Plant Industry, U. S. Dept. of Agriculture.

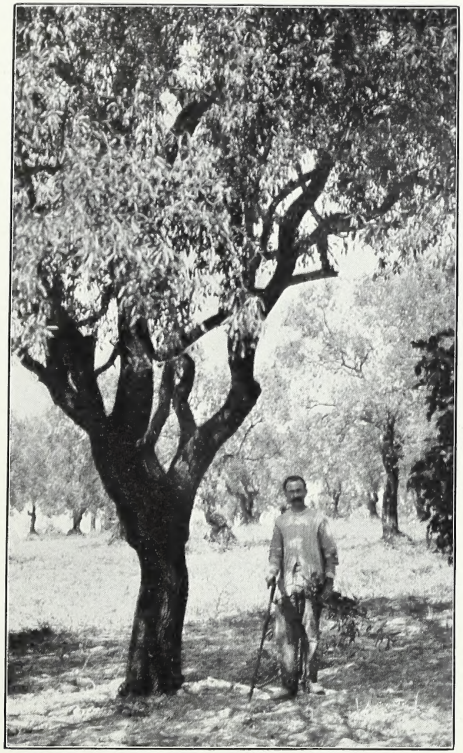

FIG. 1.—JORDAN ALMOND TREE FROM WHICH SCIONS WERE TAKEN.

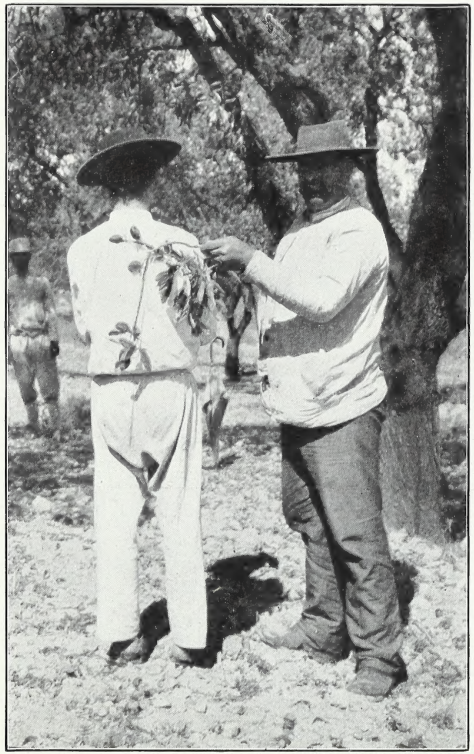

FIG. 2.—BRANCH OF RIPE JORDAN ALMONDS JUST PLUCKED FROM THE TREE.

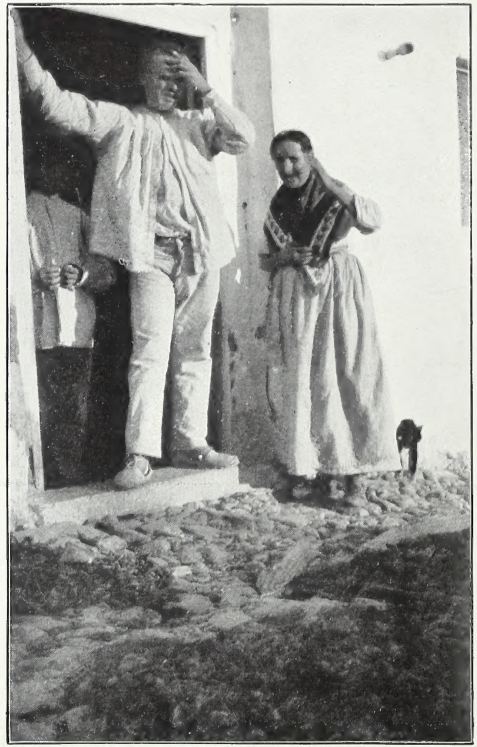

FIG. 3.—ALMOND GROWERS, DESCENDANTS OF THE MOORS.

BULLETINS OF THE BUREAU OF PLANT INDUSTRY.

The Bureau of Plant Industry, which was organized July 1, 1901, includes Vegetable Pathological and Physiological Investigations, Botanical Investigations and Experiments, Grass and Forage Plant Investigations, Pomological Investigations, and Gardens and Grounds, all of which were formerly separate divisions, and also Seed Introduction and Distribution, the Arlington Experimental Farm, Tea Investigations and Experiments, and the Congressional Seed Distribution. Beginning with the date of organization of the Bureau, the independent series of bulletins of the section of Seed and Plant Introduction, the last number of which was 22, and of each of the other divisions were discontinued, and all are now published as one series of the Bureau.

The bulletins published in this series are:

No. 1. The Relation of Lime and Magnesia to Plant Growth. 1901.
2. Spermatogenesis and Fecundation of Zamia. 1901.
3. Macaroni Wheats. 1901.
4. Range Improvement in Arizona. 1901.
5. Seeds and Plants Imported through the Section of Seed and Plant Introduction, Inventory No. 9, Nos. 4351–5500. 1902.
6. A List of American Varieties of Peppers. 1902.
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